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SOIL TESTING

as a Guide to Soil Management

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A NUMBER of questions frequently arise in the minds of farmers as they prepare their soils for crops. A few of these are: How much lime does this field need to insure good stands of clover or alfalfa? Am I using the right kind and amount of fertilizer? Where in the rotation should I apply manure? Why do crops grow so poorly on part of the field? Why is this soil so difficult to work? These and many other questions of a similar nature often occur to farmers who are thinking in terms of efficient crop production.

In order to enable farmers to obtain satisfactory answers to these questions, the Department of Agronomy, through the Agricultural Extension Service, maintains a soil testing service. No charge is made for this work. A complete examination of all samples of soil submitted is made, and the Extension Agronomists then make recommendations as to what methods of management, including the use of both fertilizers and lime, will result in the most efficient and economical production on each soil.

In making his recommendations for soil management, the agronomist relies not alone on the laboratory soil tests. Instead, he interprets these in the light of the results of long-time field experiments of the Ohio Agricultural Experiment Station, together with the experiences of successful farmers.

SOIL TESTS USED

ACIDITY TESTS

The pH Test. — The measurement of soil reaction is made by determining the *p*H electrometrically. This type of determination, when properly carried out, is an accurate measure of the concentration of hydrogen ions (or acid ions) in the soil solution. When correctly interpreted by an experienced agronomist, it enables him to give practical liming recommendations.

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The results of this determination are stated in terms of *p*H, a chemical term indicating the amount of acidity. The degree of acidity or alkalinity of a soil is expressed numerically. On the *p*H scale, 7.0 is the neutral point (neither acid nor alkaline). Values below *p*H 7.0 indicate increasing acidity with a greater need for lime. Values greater than *pH* 7.0 indicate an alkaline condition, and no lime is required.

The physical character of the soil must be carefully considered along with the *p*H test in order to draw conclusions as to the lime needs. Heavy soils such as clays or clay loams, and soil of high organic matter content, require several times as much lime to alter their *p*H value by a given amount as do light textured soils such as sands or sandy loams.

Light colored soils having a *p*H test of 6.5 (or slightly acid) generally have a satisfactory lime content even for the most acid-sensitive crops such as alfalfa or sweet clover. It is seldom profitable, and sometimes detrimental, to raise the *p*H value much above 6.5. On fertile, dark colored soils a *p*H of 6.0 may be satisfactory for all crops. When the *p*H falls below 6.5, on most light colored soils, scattered stands of alfalfa and sweet clover may be expected. For good red clover, white clover, or mammoth clover the soil *p*H should be above 5.8. Stands and growth of these crops are influenced by past fertilizer and manure treatments, erosion losses, depth to lime layer, etc. Growing such crops on acid soils does not increase their future productivity, and these crops are expensive to grow.

The soils of Ohio seldom show *p*H tests much below 4.8. Eastern Ohio light colored soils which have never been limed generally show *p*H values ranging from 5.6 to 4.8. Unlimed western Ohio soils, except in the extreme southwestern area, usually test 6.6 to 5.8 *p*H although in some sections the light colored soils are found to have a *p*H of 5.0 to 4.8. Acidity is not as injurious in western as in eastern Ohio because the subsoil in the western half of the state contains lime closer to the surface.

Active Calcium Test. — This is used to supplement the *p*H test, and is a measure of the degree to which the active colloidal portion of the soil is satisfied with calcium. A low active calcium content, coupled with a low *p*H, points to a need for an abundance of lime. A low *p*H but a moderately high active calcium content indicates that less lime will suffice. A *p*H near neutral with a low content of active calcium indicates a need for lime, while the same *p*H and a high content of active calcium indicates little or no response to liming.

The active calcium content of a soil is closely associated with the way in which the soil will be able to deliver other nutrient elements, particularly potash and phosphoric acid, to the crop.

Tests for the Available Nutrients

Phosphorus and Potassium. — These two elements are determined by measuring the amount found in a dilute acid extract of the soil. Most Ohio soils are decidedly low in available phosphorus. The only soils commonly showing a high available phosphorus content are old garden soils and soils

used for trucking for some years. Occasionally, field soils which have been heavily treated with phosphate fertilizers for years will give a high test.

The supply of available potassium in soils varies considerably. Heavy applications of manure tend to increase the available supply. Again, garden soils that have been manured frequently show an abundance of potassium available. Soils most apt to show marked deficiency in potassium are sandy soils, creek bottom soils, and muck and peat soils. Soils having a highly alkaline reaction (*p*H 7.5 or higher) also are usually deficient in available potassium.

Nitrate Nitrogen. — This test is sometimes made upon samples used in gardening or trucking. Its chief value is in indicating the need for side or top dressings with quickly available nitrogen fertilizers during the growing season. It may also be used on greenhouse soils where the supply of available nitrogen may be a limiting factor. The supply of nitrates in field soils is extremely variable, and to know the amount at any one time would be of little value except as all other limiting factors are known. To show reliable results by this test, soil samples should be dried immediately after taking from the field, otherwise nitrates may accumulate in storage.

SOIL TESTS NOT SUFFICIENT

After the soil tests have been made upon a sample which has been correctly taken, satisfactory recommendations cannot be made unless something is known concerning the cropping system, the previous handling of the soil, and any peculiar problems of the area. It is *especially important* that the *past liming treatment* of the soil be known, since the acidity is corrected in layers, rather than throughout the plow layer.

The Soil Record Sheet attached is arranged to give the information desired to accompany each sample. Fill out the blank spaces and send form with the soil sample. If more than one sample of soil is sent, obtain additional Soil Record Sheets from your County Agricultural Agent.

OBTAINING A SATISFACTORY SOIL SAMPLE

In practically all soil tests very small amounts of soil are used. Less than a teaspoonful is required for a single test. When one realizes that the results obtained by using these small amounts of soil are to be used in making interpretations for large areas, frequently many acres, it becomes *evident that the accuracy with which the sample is taken is of extreme importance.*

EVERY SAMPLE SHOULD BE A THOROUGH MIXTURE OF SOILS TAKEN FROM AT LEAST SIX PLACES. THIS IS A COMPOSITE SAMPLE.

☞ *Continued on back of this page*

Fill in the data called for on reverse side of this page, and mail it with your sample of soil to the

COUNTY AGRICULTURAL AGENT in your county

or

THE DEPARTMENT OF AGRONOMY, Ohio State University, Columbus, Ohio

TEAR OFF ON THIS LINE

Additional Soil Record Sheets (like this) may be obtained from County Agents. One should be sent with each separate composite sample of soil (see page 4 for types of composite samples).

SOIL RECORD SHEET

Farmer's Name..... Address..... County.....

Name or number of sample.....	Which samples are from same field.....	
Did this sample come from GOOD, AVERAGE, POOR area in field?.....	Check thus (√) the kind of land sample was taken from: Upland..... , First bottom..... , Second bottom.....	Is subsoil gravel or heavy?.....
How do legumes grow on the area sampled? (Good, fair, poor) Alsike clover ..... Red clover ..... Sweet clover ..... Alfalfa	What is the crop rotation desired on this soil? 1st Year ..... 2nd Year ..... 3rd Year ..... 4th Year	

Upon what crops is manure used?..... How much per acre?.....

PAST TREATMENT

LIME USED			FERTILITY TREATMENT					
Year	Amt. per acre	Material	Year	Crop	Fertilizer		Manure Rate	Yield per Acre
					Analysis	Rate		
			Present crop, or crop last grown if none now on land					
			Crop 1 year ago					
			Crop 2 years ago					
			Crop 3 years ago					

Is there a special problem with this soil?.....

TEAR OFF ON THIS LINE

Separate Composite Samples Should be Taken from:

1. Different soil types in the field. This is shown by difference in color, and also by difference in texture. Do not mix light and dark colored soils, and do not mix sandy and clay soils. Samples should be taken from typical situations ¼ to ½ acre in extent in each soil type or other area.
2. The parts of the field which have had different treatments in the past. A difference may result in the tests due to variation in the liming, or manuring, or fertilizing. Keep such composite samples separate.
3. The parts of the field on which the past growth of legumes and other crops has been noticeably different.

Methods of Taking a Soil Sample

On *general crop fields*, the sample may be taken with a spade or shovel. A vertical cut is made to plow depth (no deeper) and then the soil should be cleaned from a hole on one side of this cut. Placing a newspaper or cloth in this hole, cut a thin slice (½ to ¾ inch thick) from the vertical side of the hole (being careful to cut a uniform thickness from top to bottom), causing it to fall on the paper. Repeat this procedure at six or more locations over each soil type sampled. Place the soil in clean containers.

If an auger is available it is very convenient to use in taking samples. It should be bored into the soil to a depth of 6 to 7 inches, or to plow depth, and then pulled straight upward. The soil clinging to the auger spiral should be stripped off for the sample. A good sized auger, 1½ to 2 inches, is preferred.

When sampling soils in *permanent pastures or lawns*, the sample should be taken not deeper than 3 inches, that is, in the zone of feeding roots. A trowel or large knife may be used to obtain small slices through the turf.

Preparing the Sample

Dry each sample taken in the field by spreading it out on a piece of paper in an airy place. Avoid high temperatures, as this will ruin the sample for testing. The temperature of a living room is satisfactory, but the soils should not be placed too near a stove. When samples are dust dry, pulverize and *thoroughly mix* together the small samples which go to make up the composite sample. Select from this mixture about ½ pint for the sample to be tested. Place this in a clean container for shipment or delivery. Avoid boxes or cans in which soda or other substances of a similar nature have been present.

Label and number each sample carefully. Keep a record for yourself of what each mixed sample represents.

Shipping of Sample

It is preferable for the samples to be sent or delivered to the County Agricultural Agent located at the county seat. He is supplied with suitable shipping boxes, and will be able to assist in explaining the results of testing. Samples also may be sent directly to the Department of Agronomy, Ohio State University, Columbus, Ohio.